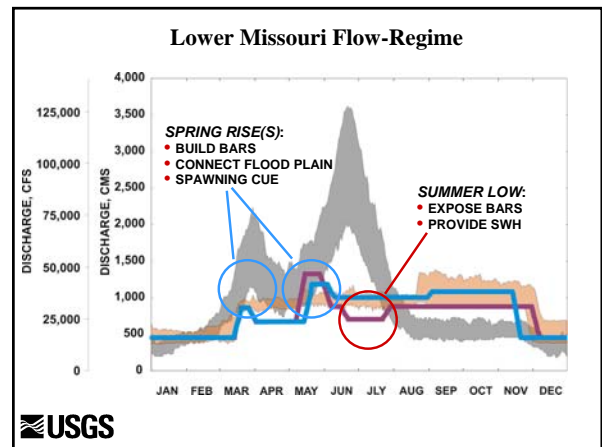
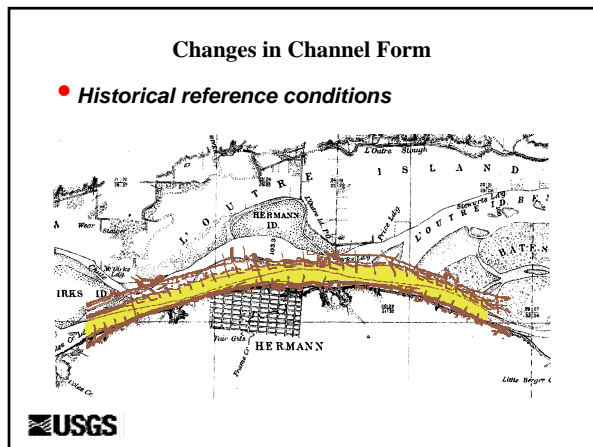
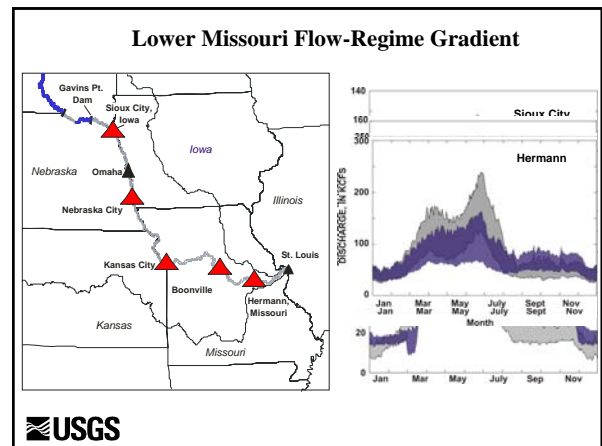


Hydrograph Design, Lower Missouri River

- Hydrologic variation, space and time
- Functions of the hydrograph
- A design approach

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Functions of the Hydrograph

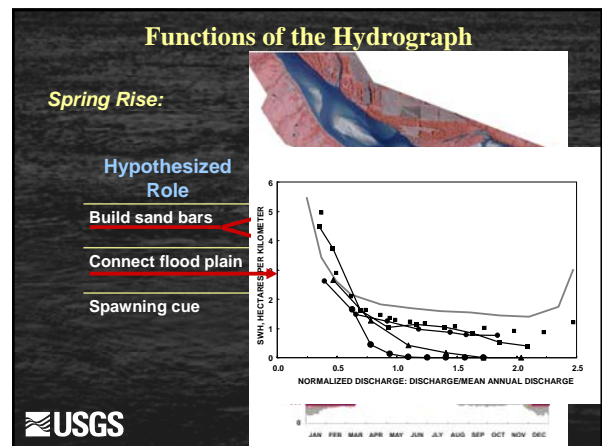
Summer Low

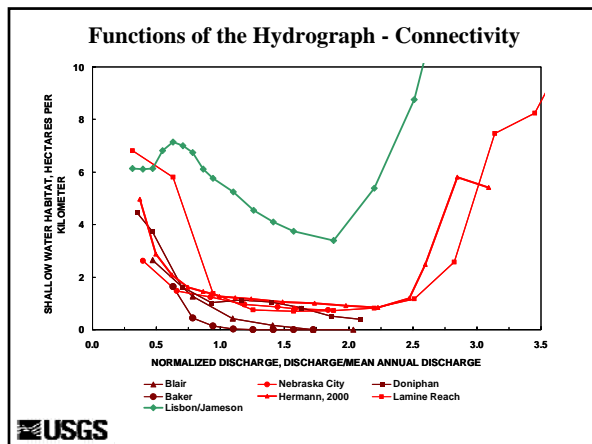
Hypothesized Role

Expose sand bars

Provide shallow-water habitat for young fish





Functions of the Hydrograph

Spring Rise:

- Hypothesized Role
- Build sand bars
- Connect flood plain
- Spawning cue

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Engineering the Hydrograph

Two approaches to designing hydrograph attributes:

- Specific biological information
- Historical hydrograph

Use sparse biologic data to constrain design; then use reference hydrograph to define range of flows characteristics.

Tools:

- Daily routing model for hydrologic scenarios
- Hydrograph analysis – IHA approach

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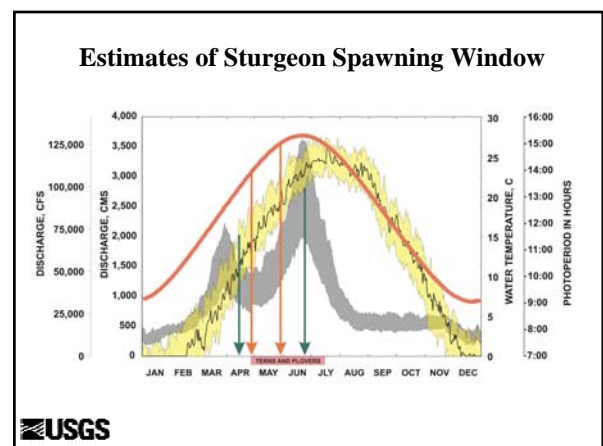
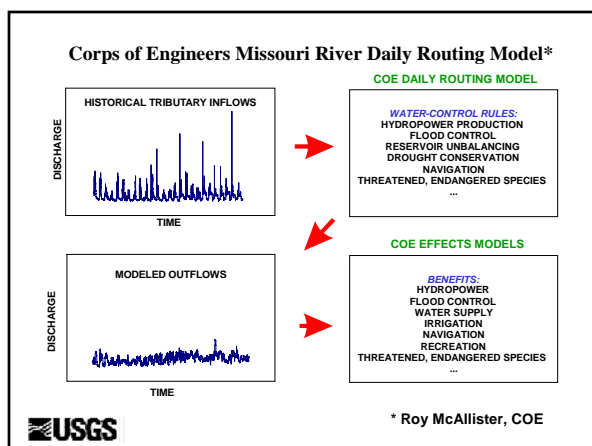
Hydrologic Scenarios

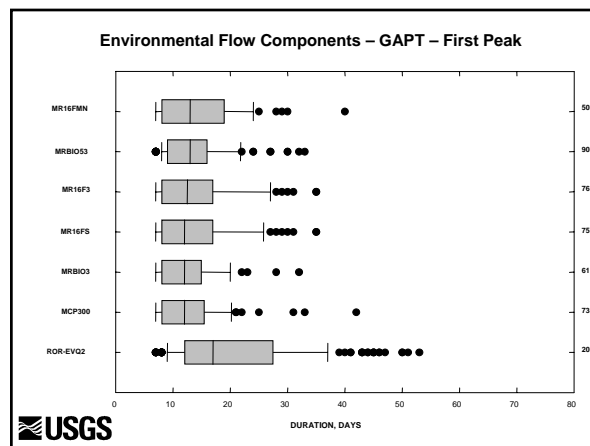
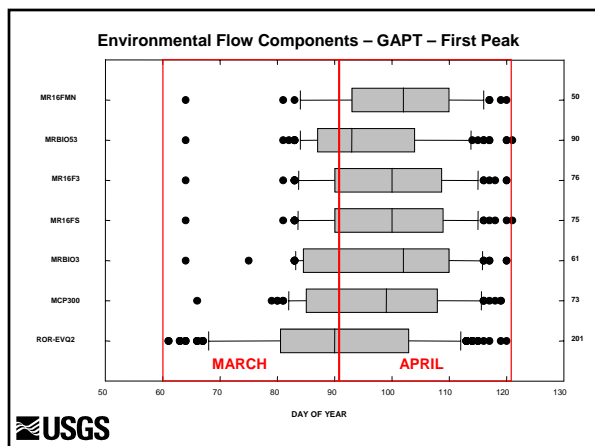
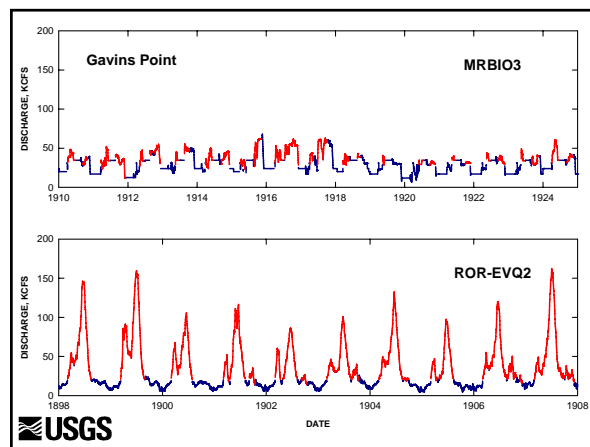
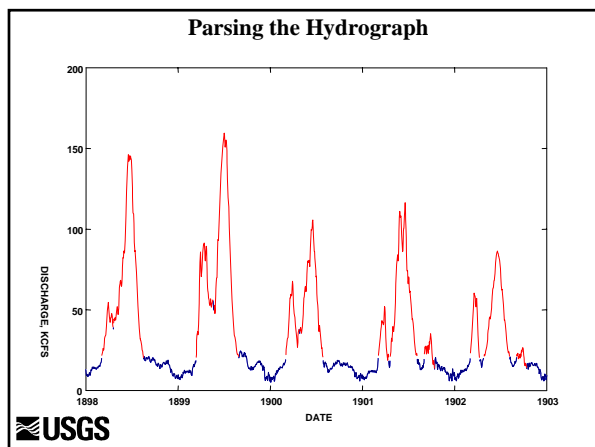
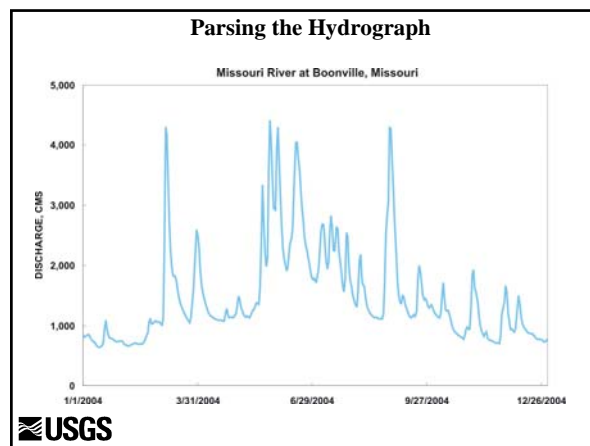
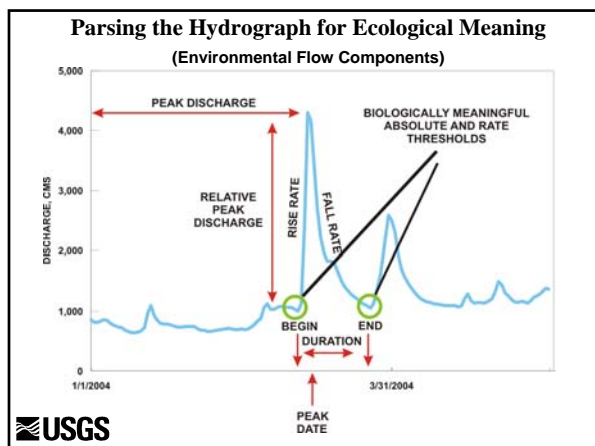
USACE Daily Routing Model

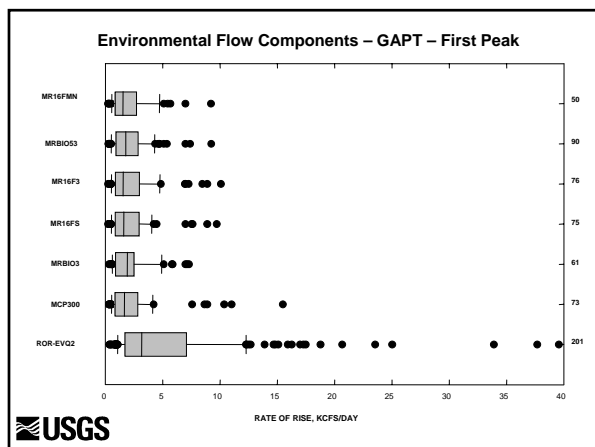
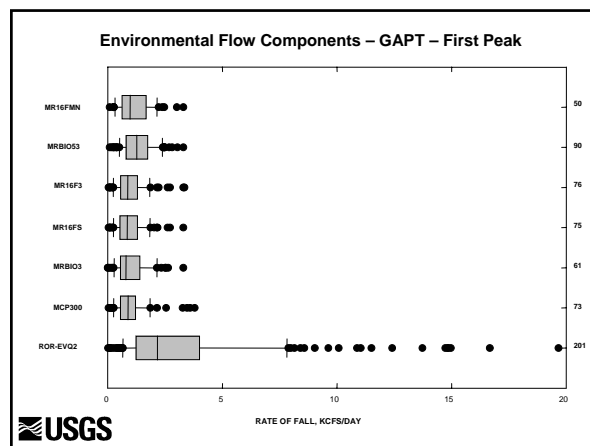
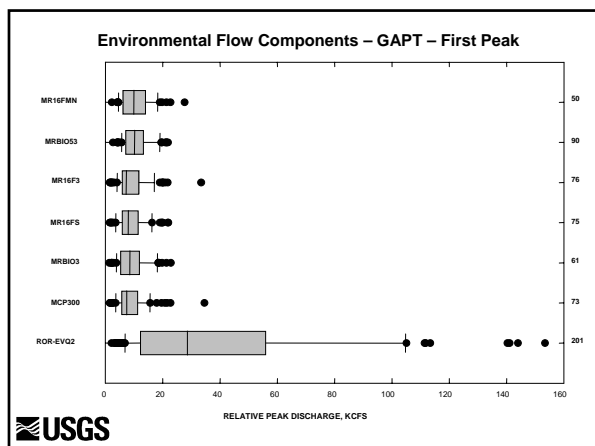
- 100 years of daily data, entire basin
- Routed to downstream gage sites
- Standard of analysis for Missouri River management

- Critical for analysis and management.
- Not easily used by stakeholders

USGS







Some Questions

- *Biological design criteria*
 - Rise for migration, spawning, dispersal?
 - Spawning on rise, or declining limb?
 - Spawning substrate conditioning?
 - Single or double SR?
 - Durations, peak or plateau?
 - Rates of rise and fall?
- SR design for information content & recovery?

USGS

